UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202 - 2733

July 12, 2018

Miguel Montoya
New Mexico Environment Department
Surface Water Quality Bureau
1190 South St. Francis Drive
P.O. Box 5469
Santa Fe, NM 87502-5469

Dear Mr. Montoya:

The Region 6 office completed its review of the Quality Assurance Project Plan (QAPP) for the ***"Upper Rio Grande Comanche Creek Watershed Based Plan (WBP)".*** The QAPP was approved on July 12, 2018 and will expire on July13, 2021.

Please submit a revised/updated QAPP at least sixty (60) days prior to the expiration date. If no substantial technical or programmatic changes have occurred in the project, submit a letter stating that no changes are needed. This letter should also be submitted at least sixty (60) days prior to the expiration date.

Attached is the completed QAPP signature page for your records. In any future correspondence relating to this QAPP, please reference QTRAK #18-444. If you have any questions, feel free to contact me at (214) 665-2259.

Sharon D. Daugherty
Environmental Protection Specialist
State/Tribal Program Section

Enclosure

GROUP A. PROJECT MANAGEMENT

A.1 TITLE AND APPROVAL SHEET

QUALITY ASSURANCE PROJECT PLAN
for
WATERSHED BASED PLAN FOR THE UPPER RIO GRANDE WATERSHED,
COMANCHE CREEK SUBWATERSHED (WBPCCS), NEW MEXICO

Approvals:

New Mexico Environment Department Surface Water Quality Bureau

Alan Klatt Date: 6/21/18
Alan Klatt, Project Officer, Watershed Protection Section

Abe Franklin Date: 6/21/18
Abe Franklin, Program Manager, Watershed Protection Section

Miguel Montoya Date: 6/21/18
Miguel Montoya, Quality Assurance Officer, Standards, Planning and Reporting Team

United States Environmental Protection Agency Region VI

Sharon Daugherty Date: 7/12/18
Sharon Daugherty, Project Officer, WQPD, EPA Region 6

Curry Jones Date: 7/12/18
Curry Jones, Chief State & Tribal Programs Section, WQPD, EPA Region 6

THIS PAGE INTENTIONALLY LEFT BLANK

A.2 TABLE CONTENTS

TABLE OF CONTENTS

List of Tables

List of Figures

Acronyms

CCW	Comanche Creek Watershed
CCWG	Comanche Creek Working Group
CE	Categorical Exclusion
CNF	Carson National Forest
EPA	United States Environmental Protection Agency
FOIA	Freedom of Information Act
MASS	Monitoring Assessment & Standards Section
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environment Department
NPS	Nonpoint Source
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPP	Project Assurance Project Plan
QC	Quality Control
SOP	Standard Operating Procedures
SSTEMP	Stream Segment Temperature Model
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
USFS	United States Forest Service
WBP	Watershed Based Plan
WPS	Watershed Protection Section
WQPD	Water Quality Protection Division

A.3 DISTRIBUTION LIST

The SWQB Project Officer is responsible for distributing this QAPP to all members of the distribution list who will review the QAPP and sign the Acknowledgment Statement prior to initiating any work for this project. The SWQB Project Officer will collect these acknowledgment statements and return them to the Quality Assurance Officer for filing with the original approved QAPP. Signed Acknowledgment forms will be kept on file at SWQB in the project file. All individuals receiving a copy of this QAPP should be signing an acknowledgement page.

New Mexico Environment Department Surface Water Quality Bureau
Project Officer/File Manager: Alan Klatt, Alan.Klatt@state.nm.us
Quality Assurance Officer: Miguel Montoya, Miguel.Montoya@state.nm.us

Quivira Coalition
Comanche Creek Program Coordinator: Mollie Walton, Ph.D., mwalton@quiviracoalition.org

USFS, Carson National Forest, Questa Ranger District
Forest Fisheries Biologist: Michael Gatlin, mrgatlin@fs.fed.us

U.S. Environmental Protection Agency Region 6
State and Tribal Programs Section Chief: Curry Jones, Jones.curry@epa.gov
Project Officer: Sharon Daugherty, Water Quality Protection Division,
Daugherty.Sharon@epa.gov

Table 1. Project Roles and Responsibilities

Name	Organization	Role	Responsibilities	Contact Information
Alan Klatt	SWQB	Project Officer/field team	Manage progress of project, process invoices, assist in data collection activities, act as liaison between cooperators, maintains project files, reviews final project report etc.	(505) 827-0388 Alan.Klatt@state.nm.us
Abe Franklin	SWQB	Non-Point Source Program Manager	Reviewing and approving QAPP, reviewing data, managing project personnel and resources	(505) 827-2981 abe.franklin@state.nm.us
Miguel Montoya	SWQB	QA Officer	Reviewing and approving QAPP, QA audits, as needed, to assure adherence to the approved QAPP	505-827-0187 Miguel.Montoya@state.nm.us
Mollie Walton	Quivira Coalition	Comanche Creek Program Coordinator/ field team	Project Contractor/ implementation of project, collection of monitoring data other than stream temperature	254-688-0348 mwalton@quiviracoalition.org
Michael Gatlin	USFS, Carson National Forest	Fisheries Biologist	Cooperator, assists with project implementation	(575) 758-6252 mrgatlin@fs.fed.us
Sharon Daugherty	U.S. EPA	EPA Project Officer	QAPP review and approval	(214) 665-2259 Sharon.Daugherty@epa.gov
Curry Jones	U.S. EPA	EPA Management	QAPP review and approval	(214) 665-6793 Jones.curry@epa.gov

A.4 PROJECT/TASK ORGANIZATION

Figure 1. details the responsibilities for this project. Each team member is responsible for implementing their assigned responsibilities. If an individual is unable to fulfill their duties it is that individual's responsibility to find assistance and/or a replacement, in coordination with appropriate supervisors.

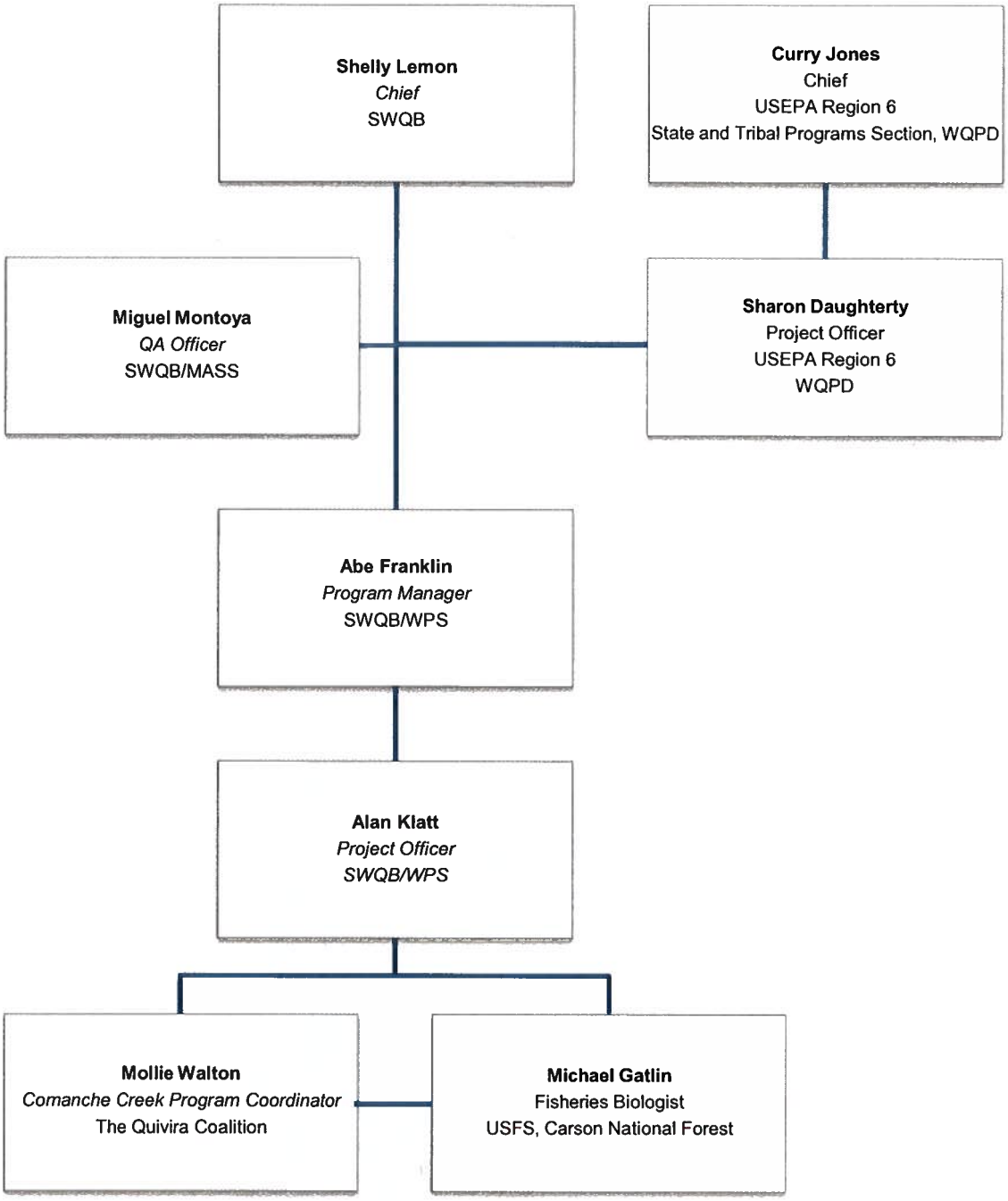

Figure 1. Organization chart

A.5 Problem Definition/Background

The purpose of this Quality Assurance Project Plan (QAPP) is to document the Watershed Based Planning technical process for the Upper Rio Grande Watershed, Comanche Creek Subwatershed (WBPCCS), New Mexico. This QAPP refers to the project as the Comanche Creek Watershed Based Plan.

This QAPP references portions of the Bureau QAPP (*Surface Water Quality Bureau Quality Assurance Project Plan for Water Quality Management Program,* NMED/SWQB 2016). The Bureau's Standard Operating Procedures are incorporated in the Bureau QAPP by reference and all relevant policies and procedures specified in the Bureau QAPP will be followed for this project. Any additional procedures unique to the project will be included in this QAPP.

When changes affect the scope, implementation or assessment of the outcome, this QAPP will be revised to keep project information current. The Project Officer, with the assistance of the Quality Assurance (QA) Officer, will determine the impact of any changes to the technical and quality objectives of the project. This QAPP will be reviewed annually by the Project Officer to determine the need for revision.

The Comanche Creek Watershed has been a focus of the Quivira Coalition and other members of the Comanche Creek Working Group (the watershed group) since 2001. Many planning documents (WRAS 2005, WAP 2014) and multiple restoration projects have taken place in the watershed over the past 17 years. The location of the Watershed is in Taos County in Northern New Mexico and within the greater upper Rio Grande watershed as shown in Figure 2.

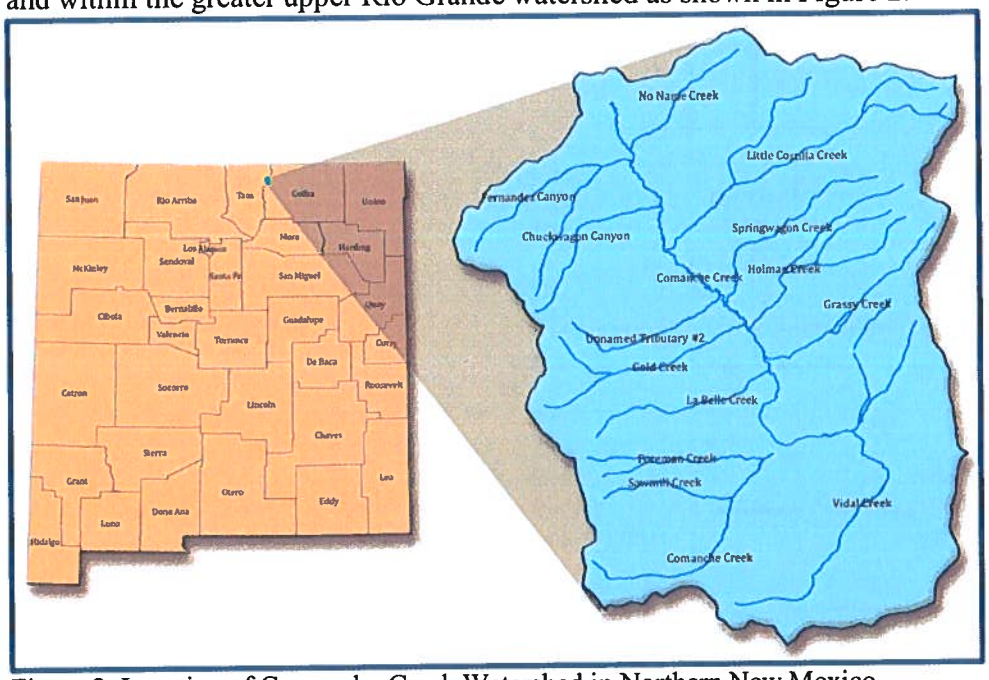

Figure 2. Location of Comanche Creek Watershed in Northern New Mexico

The Comanche Creek Watershed is 27,430 acres, or 43 square miles, and contains many tributaries that flow into Comanche Creek. Comanche Creek is approximately 10 miles from the headwaters to the confluence with Costilla Creek. It is designated as impaired for temperature for its entire length. Four tributaries to Comanche Creek are listed as impaired for temperature, while Gold Creek has an additional impairment for aluminum, and Grassy Creek is only impaired for Turbidity (NMED 2016-2018). The temperature impaired reaches add up to approximately 23 impaired creek miles, including Comanche Creek (10.29 miles), Holman Creek (2.85 miles), LaBelle Creek (2.57 miles), Gold Creek (2.87 miles), and Vidal Creek (4 miles). Creeks within the watershed are shown in Figure 3 with impaired streams in red (Figure 3).

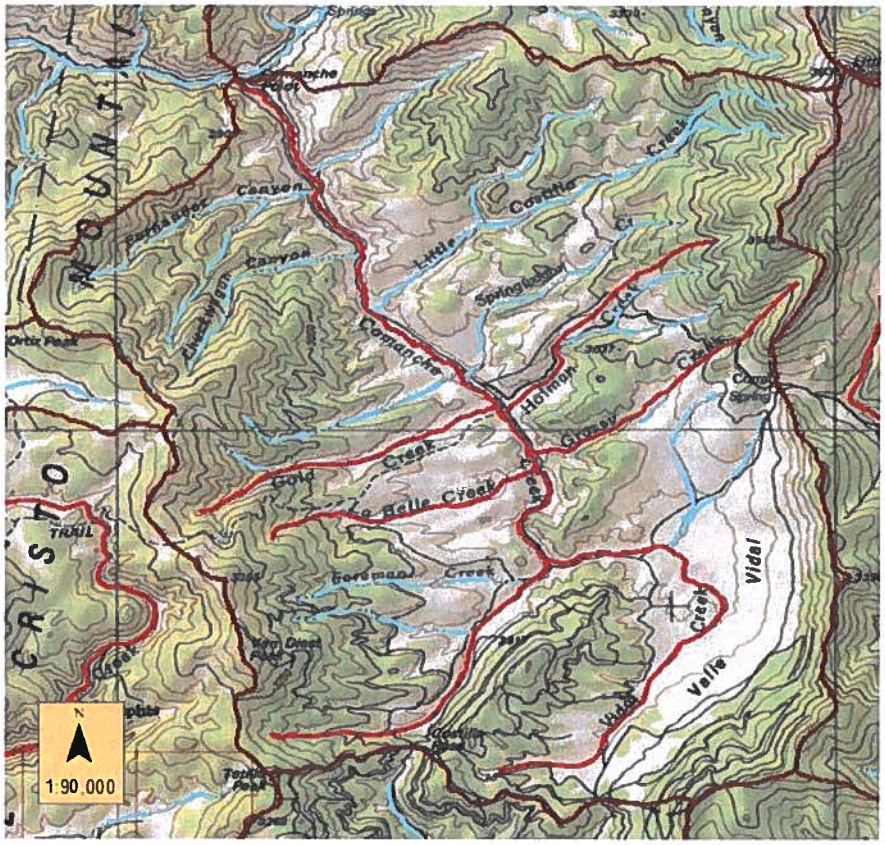

Figure 3. Impaired creeks within the Comanche Creek Watershed

The Comanche Watershed has been the stage for environmental restoration for nearly 20 years. Comanche Creek, located in the Valle Vidal Unit of the Carson National Forest, is typical of many areas that have experienced exploitive historical use of the landscape, including clear-cut timber harvesting, livestock grazing, and mineral extraction. These activities resulted in the creation of numerous inadequately constructed and maintained roads, overgrazed grasslands, depleted vegetation in riparian zones, unprotected stream banks and headcuts throughout the watershed. A detailed history and additional information about the ecological and geological setting can be found in the Wetland Action Plan for Comanche Creek referenced on the next page.

The Comanche Creek Working Group (CCWG) (the watershed association) has been at work on stabilization and restoration activities continuously since 2001. From these activities, there exists data and several planning and monitoring reports. The most important are listed below:

- Bionomics Southwest. 2003. Watershed Implementation Plan (WIP) for the Comanche Creek Watershed (prepared for the Quivira Coalition).
- Quivira Coalition. 2005. Watershed Restoration Action Strategy (WRAS) for the Comanche Creek Watershed.
- Quivira Coalition. 2015a. The Rio Grande Cutthroat Trout (RGCT) Habitat Barrier Assessment and Removal Project. Funded by a USFWS Fish Passage Barrier Removal Grant.
- Zeedyk, B., M. Walton, and T. E. Gadzia. 2014. Characterization and Restoration of Slope Wetlands in New Mexico: A Guide for Understanding Slope Wetlands, Causes of Degradation and Treatment Options. New Mexico Environment Department, Surface Water Quality Bureau, Wetlands Program.
- Quivira Coalition. 2015b. Wetland Action Plan (WAP), Comanche Creek Watershed.
- Watershed Artisans. 2017. Comanche Creek Watershed Restoration Design Concept.

Resulting from the assessment of the Comanche Creek Watershed to identify and prioritize fish passage barriers in all tributaries to Comanche Creek (Quivira 2015a), the CCWG has data on headcuts more than 12 inches in depth and locations of problematic road crossings and culverts. There are many internal planning documents from the Carson National Forest. The two most important to watershed work are listed below.

- Current National Environmental Policy Act (NEPA) and Categorical Exclusion (CE) documents, signed by Jerome Mastel, District Ranger of the Carson National Forest, allowing for restoration activities in the Comanche Creek Watershed.
- Draft version of the Watershed Restoration Action Plan (WRAP) that is currently being written by the Carson National Forest: FY2014-FY2024 Transition Watershed Restoration Action Plan (DRAFT)—Comanche Creek Watershed, Valle Vidal Management Unit. USDA Forest Service, Carson National Forest.

There have also been two master's theses completed by students at the University of New Mexico Water Resources Program.

- Weiss, R. M. 2008. Fluvial Geomorphic Response to In-stream Structures: The Effects of Design, Planning and Restoration of the Comanche Creek Catchment, New Mexico. Master's Thesis, Water Resources Program, University of New Mexico.

- Allred, J. M. 2005. Evaluating the Effectiveness of Induced Meandering within an Incised, Discontinuous Gully System Post Wildfire within the Valle Vidal, Carson National Forest, New Mexico. Master's Thesis, Water Resources Program, University of New Mexico.

There are many sources of information on water quality for the Comanche Creek Watershed as assessed by Environmental Protection Agency (EPA) Reports and the New Mexico Environment Department (NMED), Surface Water Quality Bureau (SWQB) as well as other state agencies. These documents are included in Appendix A.

The results of these land use practices have led to increased erosion of the land that has amplified the fine sediment load within the watershed, specifically along Comanche Creek. Comanche Creek, a high-quality coldwater fishery that is also home to the Rio Grande Cutthroat Trout, a Species of Concern (NMDGF 2006), is listed for temperature and sediment on the 2006 303(d) list of impaired waters. These bottom deposits and high temperatures negatively affect habitat for fish and other aquatic life. In the 2014-2016 CWA 303(d)/305(b) Integrated List and Report, Temperature remains a concern, but Comanche Creek has been delisted for sediment due to restoration efforts.

Past restoration practices include mini-exclosures along streambanks to promote riparian recovery, in-stream structures to recreate deep pools and meanders, road improvements and closures to decrease sediment input and improved grazing management practices to restore grasslands. These practices are improving the condition of the Comanche Watershed, and although wetland conditions are improving as a result, it has not previously been documented. In addition, these practices have been mainly implemented in the lower reaches of the watershed that are not so remotely located. The upper reaches where slope wetlands occur are still degrading from headcuts and gullies, sedimentation and channelization.

In the 2011, NMED TMDL Report, many sections of Comanche Creek were successfully delisted for sediment exceedances in response to restoration efforts in the watershed. In 2013, Comanche Creek was featured as a Section 319 Nonpoint Source Program Success Story (EPA 2013). However, portions of La Belle Creek, Holman Creek, and Gold Creek are still listed for TMDL temperature exceedance (Table 2, Figure 3). Probable current sources for impairment include rangeland grazing, impact on riparian habitat by cattle and elk in the absence of predators, and loss of riparian habitat due to eroded and destabilized watershed conditions (NMED 2014-2016).

EPA funding under Section 319 of the Clean Water Act provides resources to address Total Maximum Daily Load (TMDL) exceedances for the following creeks within the watershed (Table 2).

Table 2. Comanche Creek watershed tributaries listed in the 2014-2016 CWA 303(d)/305(b) Integrated List and Report with a completed TMDL

Impaired Creek	Assessment Unit ID	Impairment TMDL	Probable Sources
Comanche Creek	NM-2120.A_827	Temperature	Channelization, hydro-modification, drought-related impacts, forest roads, low water crossing, rangeland grazing, and wildlife other than waterfowl
Gold Creek	NM-2120.A_835	Temperature, Aluminum	Channelization, drought-related impacts, forest roads and low water crossing, rangeland grazing, wildlife other than waterfowl, and unknown sources
Holman Creek	NM-2120.A_837	Temperature	Channelization, drought-related impacts, forest roads and low water crossing, rangeland grazing, and wildlife other than waterfowl
LaBelle Creek	NM-2120.A_839	Temperature	Channelization, drought-related impacts, forest roads and low water crossing, rangeland grazing, and wildlife other than waterfowl

A.6 Project Task Description

Description

The goal of this project is to collect data that will be used for an EPA approved Watershed Based Plan (WBP) for the Comanche Creek Watershed. The WBP will focus on identifying places where restoration activities will contribute to the overall goal of reducing stream temperatures in impaired reaches of the watershed to restore high quality habitat for coldwater aquatic life and to meet the Water Quality Standard (WQS) that supports the designated use for High Quality Coldwater Aquatic Life.

Reductions goals follow the reductions listed in the TMDL for the Waters of the Valle Vidal and the TMDL for the Upper Rio Grande Watershed-Part 1. Using SSTEMP the TMDL determined that the WQS for stream temperature could be achieved for Comanche Creek (Costilla Creek to Little Costilla Creek) by increasing total shade from 4.5% to 52% (Table 3). Achieving the stream temperature goals will likely require a combination of treatment types in addition to shade modification.

Table 3. TMDL Reduction Goals

Assessment Unit	Reduction in Solar Radiation [joules/m²/sec]	% Total Shade needed to meet Radiation Reduction
Comanche Creek (Costilla Creek to Little Costilla Creek)	139.3	52 %
Gold Creek (Comanche Creek to headwaters)	98.91	34%
Holman Creek (Comanche Creek to headwaters)	42.95	31.5%
LaBelle Creek (Comanche Creek to headwaters)	41.36	22%

Restoration work was completed in Gold Creek in 2015 with grant funds from the National Forest Foundation via the Coca-Cola® Company. This work will hopefully result in a reduction of aluminum in the waters of Gold Creek. Determining if there are sources of upland erosion and destabilized banks that were not treated in 2015 and that will need to be treated in the future will be a priority in the Watershed Based Plan. Also using funds from the Coca-Cola® Company projects, the majority of the mainstem of Comanche Creek will have been treated with restoration structures designed to increase hyporheic flow into surrounding wetland soil, raise the stream grade, increase habitat complexity for aquatic life, and decrease the stream channel width-to-depth ratio.

Data gaps exist in that there is no information on flow volumes for any of the smaller tributaries. All partners in the CCWG are committed to data sharing in order to determine where these gaps may be filled by the CCWG. Michael Gatlin of the Carson National Forest is spearheading this effort.

Table 4. Products and Timeline

Task	Timelines	Deliverable
Stakeholder Engagement	April 2018 and December 2018	Stakeholder feedback on potential restoration treatments that will reduce temperatures
Complete QAPP	June 2018	Complete Quality Assurance Project Plan ensuring measures are in place to collect quality data.
Field assessment of impaired reaches, record data for stream flow, conduct channel width-to-depth	July 2018 to October 2018	Completed impaired reach assessments, data collection for tributary contribution to stream flow, width-to-depth ratios, greenline vegetation transect data, photodocumentation

measures as a component of geomorphic cross sections, survey greenline vegetation, photodocumentation at geomorphic cross sections and record Global Positioning System (GPS) latitude/longitude for data collection sites		stations established (recorded with GPS) and photodocumentation data,
Data Analysis of NMED stream temperature data and field data collected	October 2018 to November 2018	Results and analysis of field data collection.
SSTEMP modelling	September 2018	Production of theoretical treatment goals that could decrease stream temperatures through riparian plantings (willow and herbaceous wetland vegetation where appropriate).
Compilation of Historic Data	December 2018 to January 2019	Complete report of Comanche Creek Watershed data collection and restoration efforts.
Watershed Based Plan Document	February 2019	A Comanche Creek Watershed Based Plan with prioritized restoration sites, load reduction estimates, a long-term monitoring plan, potential funding sources, and a schedule for implementation of theoretical treatments for submission to the EPA for approval.

The overall project outcome in this project will be to identify places where restoration activities will contribute to the overall goal of reducing stream temperatures in impaired reaches of the watershed.

Stakeholder engagement is a necessary component of producing a comprehensive WBP for the Comanche Creek Watershed. Multiple collaborators are and have been working in the Comanche Creek Watershed for decades and have valuable knowledge to contribute to the completed WBP. Completing the QAPP is a required component of the overall project in order to ensure that WBP recommendations are based on quality data and information. Field assessments of impaired reaches are necessary because of changing conditions in the watershed due to natural processes as

well as to evaluate the results of recent restoration projects that will inform WBP goals. Stream flow data will inform water quantity contributions from upper tributaries to assist in prioritization efforts. For example, if one stream is contributing more flow to the Comanche Creek mainstem than another, it will yield information to be paired with the field assessments to determine if restoration treatments can either improve/increase flow to the Comanche Creek mainstem, or if the tributary is a low priority for future restoration treatments due to smaller inputs to stream flow. In a system that is largely a grassland (herbaceous) riparian system, channel width-to-depth ratios may provide better information on stream temperature than canopy cover. Baseline vegetation data will inform how far the wetland vegetation extends from the stream channel. Greenline vegetation data is a proxy measurement for soil saturation distance from the stream channel. Photodocumentation will be used to support results from surveys conducted under this project. Thermograph stream temperature data from NMED SWQB NPS effectiveness monitoring program will be utilized to assess current stream temperature conditions as well as trends in the long-term data set. SSTEMP modelling is a standard tool used to model shading treatment affects to reach temperature reduction goals. Analysis of these data will allow project stakeholders to determine the best recommendations for restoration treatments sites and potential treatment types for the WBP. Compilation of the WBP is an opportunity to pull many disparate documents and datasets together in one comprehensive plan.

A.7 Quality Objectives and Criteria for Measurement Data

The purpose of this section is to specify the level of quality needed to make decisions regarding the success of the project. As part of safety and quality assurance at least two persons will be in the field collecting data at all times. Many of tasks associated with this project can only be evaluated anecdotally and the quality of the information used for this assessment will be ensured as indicated in the following data quality categories:

Precision - The basis for determining precision will be the comparison of photodocumentation of prior and post project construction activity images. Greenline transects (vegetation monitoring) and geomorphic cross sections will all be monumented for repeat sampling events for the life of project. Precision will also be ensured by consistently assigning the same people the responsibilities of collecting, recording and analyzing data with the expert assessments of members of the SWQB project team.

Accuracy - The basis for determining accuracy will be the comparison of photodocumentation, measurements obtained from predetermined monument locations, the recording of GPS location data for each sampling event as well as through the expert assessments of members of the SWQB project team.

Table 5. Accuracy of data collection tasks

Data Collection	Accuracy
Greenline vegetation monitoring	Horizontal accuracy approximately +/- 1 inch/100 feet (accuracy of a fiberglass tape measure in field conditions).
Streamflow – Velocity Float Method	This flow measurement method typically has low accuracy. Time of travel will be conducted at least 3 times per EPA protocol. Indication of the accuracy can be ascertained by the variation of each measurement.
Width and depth measurements	Horizontal accuracy approximately +/- 1 inch/100 feet (accuracy of a fiberglass tape measure in field conditions) and a vertical accuracy within +/- 0.05 feet (rod and laser level).
Percent Canopy	Approximately +/- 2.4% at 95% probability level (Lemmon, 1957) as amended by SWQB 2016 Physical Habitat Measurements SOP
Repeat Photography	Photos will be standardized by camera location, height, angle, and direction following the above-mentioned protocol to ensure sufficient accuracy for photo documentation.

Bias – To reduce the systematic or persistent distortion of any measurement process, bias will be minimized by using professional and experienced staff to collect and analyze data.

Representativeness – In order to complete a WBP, data collection will be completed at multiple sites within the Comanche Creek Watershed that are representative of the WBP project area.

Comparability - This project will collect new data where no data is available for comparison. However, methods for data collection are standardized and reproducible using procedures identified in this QAPP. Vegetation, hydrological and geomorphic monitoring employ established methods that can be compared to other data collected with same methods.

Completeness - Completeness will be achieved by following the sampling design and methods within this QAPP required to obtain useable data that will enable the proper evaluation of project success or failure using the expert assessments of members of the SWQB project team. Complete survey data will be ensured by collecting all of the required data for each sampling method and verifying before leaving the field.

A.8 Special Training/Certification

Data collection and monitoring will primarily be carried out by Mollie Walton, Ph.D. of the Quivira Coalition and Alan Klatt, Project Officer, and SWQB staff. All SWQB staff that may

collect data for this project have training or will be trained to collect data specific to this project. If contractors are needed to fulfil data collection requirements, at any point during the project, to insure completeness, the following requirements will be adhered to:

Any contractor/subcontractor performing vegetation monitoring will be required to have the minimum of a bachelor's degree related to biology, botany, or conservation. The contractors and subcontractors must have experience collecting vegetation data using the techniques listed in this QAPP.

Any contractor/subcontractor performing stream width-to-depth ratio measurements have demonstrated survey skills and a background in fluvial geomorphology, which could include university coursework, experience/training in riparian/wetland/stream ecology, familiarity with channel evolution concepts and models, or a successful project design and implementation track record in which determining the natural potential of a site was documented with professionally accepted methodologies.

Contractor qualifications will be documented through resume and professional references. The qualifications will be reviewed by the SWQB Project Officer for this project. The documentation of this information will be kept in the SWQB project files managed by the SWQB Project Officer.

A.9 Documents and Records

Copies of this QAPP and any subsequent revisions will be provided to all individuals included on the distribution list by the SWQB Project Officer. The SWQB Project Officer will also distribute all applicable protocol documents and subsequent revisions used throughout the project to the appropriate contractors. The QAPP, signed QAPP acknowledgement pages, protocol documents and monitoring reports will be maintained by the SWQB Project Officer in the project file at the SWQB in Santa Fe, NM.

Data acquisition will be obtained and processed by Mollie Walton of Quivira and Alan Klatt of NMED/SWQB. They will provide processed data to Abe Franklin who is qualified to be the reviewer, who will not have been involved in the specific data acquisition requiring review. Once data has been reviewed it will be returned to the project officer with a short review report that describes why data is acceptable or not and any questions the reviewer may have about the data.

GROUP B. Data Generation and Acquisition

B.1 Sampling Design

Visual stream and riparian condition assessments will be conducted by Mollie Walton, Ph.D., a trained and experienced restoration ecologist. The entire lengths of Holman, Gold and LaBelle Creeks will be walked to assess and identify current conditions which may be contributing to higher water temperatures. Field notes and supplemental photographs will be recorded in a standard survey book. Notes will include location data (GPS coordinates), notes on conditions contributing to stream impairment, and potential sites for restoration treatments. These data will be added to existing assessment data.

The monitoring components to be employed are: 1) stream flow contributions from tributaries, 2) width-to-depth ratios along the Comanche Creek mainstem as a component of geomorphic cross sections, 3) greenline vegetation monitoring 4) stream canopy cover, and 5) photodocumentation of geomorphic transects where data collection occurs. The rationale, methods, data to be collected, and equipment are described for each component below.

Stream flow of Comanche Creek will be recorded above and below each tributary confluence with Comanche Creek. Stream flow will be collected during the assessment of reaches identified above and during geomorphic cross section surveys.

Locations of width-to-depth ratio measurements to best represent overall site conditions within portion of stream segments on the Comanche Creek mainstem will be determined in the field by Mollie Walton, Ph. D. based on experience and professional judgement. Greenline transects and stream canopy cover will be performed in stream segments where width-to-depth ratio measurements are recorded. A limited number of survey transects will be recorded on both restored and unrestored reach segments.

Photodocumentation will also be employed at geomorphic cross sections. Photo point markers will be carefully located and monumented with rebar pins. Locations will be recorded with a GPS unit, plotted on scaled maps, and verified for accuracy. These photos will provide a broad view of the site.

Thermograph data will be provided by NMED SWQB WPS. The project will utilize NMED SWQB NPS effectiveness monitoring program thermographs (SWQB thermographs) for stream temperature from the following monitoring location (Table 6). Thermograph stream temperature data will be utilized to assess current stream temperature conditions as well as trends in the long-term data set.

Table 6. NMED-SWQB Stream Temperature Monitoring Locations

Site Name	ID_CODE	LAT_DD_NAD_83	LONG_DD_NAD_83
Comanche Creek above Little Costilla Creek	CC-ALCO	36.795700	-105.297050
Comanche Creek below Little Costilla Creek	CC-BLCO	36.795860	-105.298030
Comanche Creek abv confluence w Vidal Creek near abandoned Clayton cabin up Forest Rd 1905	CC-CABN	36.756060	-105.269590
Comanche Creek abv Costilla Creek	CC-CONF	36.831710	-105.318310
Comanche at USFS #8 0.8 km upstream of confluence	CC-DWN8	36.827750	-105.312917
Comanche Creek above Costilla Creek	CC-LOWS	36.828230	-105.314000
Comanche Creek abv Holman creek	CC-UPPR	36.779500	-105.276417
Comanche Creek blw Vidal Creek	CC-VIDA	36.758301	-105.270889

B.2 Sampling Methods

Stream velocity measurements will be conducted both upstream and downstream of tributary confluences with Comanche Creek using the float method to estimate stream flow. The method used is detailed on the EPA web site https://archive.epa.gov/water/archive/web/html/vms51.html [Accessed April 4, 2018].

Width-to-depth ratios as a component of geomorphic cross sections (channel dimensions) will be surveyed according to the Rosgen (1994) methodology. Channel morphology measurements will feed into SSTEMP modeling.

Greenline vegetation monitoring will be performed using the protocol established in *Monitoring the Vegetation Resources in Riparian Areas* (Winward, 2000).

Stream canopy cover will be collected following procedures outlined under section 6.3.3 pertaining to Percent Canopy Cover in SWQB's SOP for Physical habitat (SOP 5.0). Baseline densiometer values will be used in SSTEMP to inform the model.

The photodocumentation monitoring will be performed according to protocol established in *"Let the Water Do the Work", Appendix I, Outline for Photographic Monitoring Plan* (Zeedyk, *et al.* 2009) will be used.

Data from SWQB thermographs data loggers are deployed and maintained by NMED SWQB NPS effectiveness monitoring coordinator. Deployment methodology follows SWQB's SOP for Thermographs (SOP 6.3). Data collected from SWQB thermographs will be verified and validated in accordance with NPS Program Effectiveness Assessment, 2008-2011 Final Report (Data Processing and Management section). Baseline temperature data will also be used in SSTEMP to define solar load reductions necessary to meet surface water quality standards

B.3 Sample Handling and Custody

No physical samples will be collected; therefore, there will be no handling and chain of custody requirements.

B.4 Analytical Methods

There will be no samples collected for analysis.

B.5 Quality Control

Quality control (QC) activities are technical activities performed on a routine basis to quantify the variability that is inherent to any environmental data measurement activity. The purpose for conducting QC activities is to understand and incorporate the effects the variability may have in the decision making process. Additionally, the results obtained from the QC analysis, or data quality assessment, may identify areas where the variability can be reduced or eliminated in future data collection efforts, thereby improving the overall quality of the project being implemented.

Quality Control mechanisms are implemented as described under the Quality Objectives and Criteria as well as the sampling design and methodologies identified under this QAPP. Additional Quality Control includes the professional expertise of the personnel working under this project.

B.6 Instrument/Equipment Testing

Thermographs will be maintained, tested and inspected by SWQB NPS effectiveness monitoring coordinator in accordance with SWQB's SOP for Thermographs (SOP 6.3). The HOBO®Water Temp Pro v2 dataloggers (Onset Computer Corporation) will be deployed by SWQB NPS effectiveness monitoring coordinator or delegated to trained SWQB staff. The HOBO®Water Temp Pro v2 dataloggers data will be downloaded and managed in HOBOware Pro® software by SWQB NPS effectiveness monitoring coordinator .

B.7 Instrument/Equipment Calibration and Frequency

For this project, data used from SWQB thermograph data loggers will be calibrated and maintained as specified in SWQB's SOP for Thermographs (SOP 6.3) by SWQB NPS effectiveness monitoring coordinator.

Laser level survey equipment will be inspected prior to use and a repeat measure will be taken during each geomorphic cross section recording to ensure that the unit is accurate.

Greenline vegetation transects will be conducted and managed by Mollie Walton, Ph.D., a trained and experienced restoration ecologist.

For stream canopy cover measurements, the same individual will be conducting and recording survey throughout the project. The densiometer will be inspected prior to each use to determine if there is damage that would make the instrument unusable.

B.8 Inspection/Acceptance of Supplies and Consumables

There are no supplies or consumables that could affect the quality of data related to this project.

B.9 Non-Direct Measurements

Existing data from the Carson National Forest, NMED SWQB NPS effectiveness monitoring program, and the Quivira Coalition will be used to identify data gaps and inform future data collection needs.

B.10 Data Management

Field data, such as stream reach impairment notes and photographs, greenline vegetation transects, width and depth measurements, geomorphic measurements (stream cross sectional profiles), densiometer data, and GPS coordinates, will be recorded on field sheets and field notebooks. These will be checked for completeness (no missing data fields) by Mollie Walton or Alan Klatt before leaving the site and immediately scanned upon return from the field. Electronic data will be transferred from laptops, cameras, thermographs, and GPS units to NMED SWQB and the Quivira

Coalition for back up and redundancy. NMED will maintain the data in File Depot, NMED's network file storage system that is regularly backed-up and secure. The Quivira Coalition will maintain the data on an external hard drive and in a Google Cloud server location.

GROUP C. ASSESSMENT AND OVERSIGHT

C.1 ASSESSMENT AND RESPONSE ACTIONS

Assessments and response actions will be reported as described below in C.2. The SWQB Project Officer will provide project oversight by periodically assisting with and/or reviewing data collection efforts, twice per year during the life of the project. The Project Officer will assess project progress to ensure the QAPP is being implemented, including periodic audits by the QAO, as needed. Any problems encountered during the course of this project will be immediately reported to the Project Officer who will consult with appropriate individuals to determine appropriate action. Should the corrective action impact the project or data quality, the Project Officer will alert the QAO. If it is discovered that monitoring methodologies must deviate from the approved QAPP, a revised QAPP must be approved before work can be continued. Quarterly reports will describe the progress of the project tasks and any potential problems with task implementation or schedule. This process includes justification for adjusting the task, or the task schedule and making adjustments to the timeline if applicable. All problems and adjustments to the project plan will be documented in the project file and included in the final report.

C.2 REPORTS TO MANAGEMENT

Quarterly reports are submitted by the Quivira Coalition to the SWQB Project Officer and include progress of project implementation and any available data. Printouts, status reports or special reports for SWQB or EPA will be prepared upon request. Monitoring data and analysis will be included in the final report. The SWQB Project Officer will be responsible for maintaining project progress in the EPA Grants Reporting and Tracking System and final report, and all other required project deliverables to be submitted to the EPA under this grant.

GROUP D. DATA VALIDATION AND USABILITY

D.1 DATA REVIEW: VERIFICATION AND VALIDATION

Data will be reviewed by the Quivira Coalition prior to demobilization from the field site. Data will be considered usable if the requirements of this QAPP were followed and the data is within acceptable range limits as defined under this QAPP. Data that appears incomplete or questionable for a parameter will be flagged for review. Flagged data will be discussed with the Project Officer to determine the potential cause and usability. If a reasonable justification for use of the data cannot be attained, those data will be not used in analysis for the completion of a Watershed Based Plan on Comanche Creek, unless the data can be recollected and assessed for usability. The Project

Officer and/or QA Officer are responsible for determining if the data was collected according the QAPP.

D.2 Verification and Validation Methods

Project data will be verified and validated according to the procedures, as applicable, in SWQB SOP Data Verification and Validation (SOP 15.0). Verification and validation issues will be resolved by Mollie Walton, Ph.D. of Quivira Coalition. Verification issues include the completeness of the record, and verification of calibration. Validation issues include the review of data for anomalous data points and removal of data points based on reasonable explanation. Validation will be done by an individual who did not collect data.

Results of the validation process will be conveyed using validation and verification worksheets attached as Data Verification Worksheet and will also be explained in final report.

D.3 Reconciliation with User Requirements

The user requirement is a restatement of the data quality objective: The data should be adequate to provide a high level of confidence in assisting in the determination of site-specific activities to address impairments within the Comanche Creek WBP.

If project results do not meet this requirement, then additional monitoring may be necessary to fill in data gaps or it may be necessary to extend the monitoring period to measure effects that were not apparent during the project period.

5.0 REFERENCES

Lemmon, Paul. 1957. A New Instrument for Measuring Forest Overstory Density. Journal of Forestry, Volume 55, Number 9. Accessed from Forestry Suppliers Inc. on 5/30/2018 https://www.forestry-suppliers.com/Documents/1450_msds.pdf

EPA 2013. Nonpoint Source Success Stories. http://water.epa.gov/polwaste/nps/success319.

NMED/SWQB 2016. Quality Assurance Project Plan for Water Quality Management Programs. New Mexico Environment Department/Surface Water Quality Bureau. https://www.env.nm.gov/swqb/QAPP/2016QAPPFinal_Complete_withAppendices_Approval_Signatures.pdf

New Mexico Environment Department, Surface Water Quality Bureau, Monitoring, Assessment and Standards. 2011. US EPA-Approved TMDL for the Upper Rio Grande Watershed - Part 1. Html. https://www.env.nm.gov/swqb/Rio_Grande/Upper/2004/index.

New Mexico Environment Department, Surface Water Quality Bureau, Monitoring, Assessment and Standards. 2011. US EPA-Approved TMDL for Waters of the Valle Vidal. http://www.nmenv.state.nm.us/swqb/ValleVidal/

New Mexico Environment Department, Nonpoint Source Program Effectiveness Assessment, 2008-2011, Final Report. New Mexico Environment Department, Surface Water Quality Bureau, Watershed Protection Section. https://www.env.nm.gov/swqb/documents/swqbdocs/WPS/Effectiveness/NPSEffectivenessAssessment2008-2011.pdf

NMED/SWQB 2016. New Mexico Environment Department Standard Operating Procedures for Temperature Data Loggers (Thermographs). SOP 6.3. Effective March 15, 2016. https://www.env.nm.gov/swqb/SOP/documents/6.3_SOP_Thermograph_4-11-2016.pdf

NMED/SWQB 2016. New Mexico Environment Department Standard Operating Procedures for Physical Habitat Measurements. SOP 5.0. Percent Canopy Effective April 15, 2016. https://www.env.nm.gov/swqb/SOP/5.0SOP-PhysicalHabitat2014.pdf

NMED/SWQB 2014-2016. 2014 – 2016 State of New Mexico Clean Water Act Section 303(d)/Section 305(b) Integrated Report, Appendix A – Integrated List. https://www.env.nm.gov/swqb/protocols/documents/AssessmentProtocol-w-Appendices-2014.pdf

NMED/SWQB 2016-2018. 2016 – 2018 State of New Mexico Clean Water Act Section 303(d)/Section 305(b) Integrated Report, Appendix A – Integrated List. https://www.env.nm.gov/swqb/protocols/documents/2016_FINAL_AP_062215.pdf

Rosgen, Dave. 1996. *Applied River Morphology.* Wildland Hydrology, Pagosa Springs, CO.

Schoeneburger, P.A., Wysoki, D.A., Benham, E.C., and Broderson, W.D. (editors), 2002. Field book for describing and sampling soils, Version 2.0. Natural Conservation Resources Service, National Soil Survey Center, Lincoln, NE.

Winward, Alma H. *Monitoring the Vegetation Resources in Riparian Areas.* 2000. US Department of Agriculture, Forest Service, Rocky Mountain Research Station, Gen. Tech. Report RMRS-GTR-47.

Zeedyk, Bill; Clothier, Van 2009. *Let the Water Do the Work,* Appendix I, Outline for Photographic Monitoring Plan. The Quivira Coalition, Santa Fe, NM

6.0 APPENDIX A

New Mexico Department of Game and Fish. Fisheries Management Division. 2006. Restoration of Rio Grande Cutthroat Trout (Oncorhynchus clarki virginalis) and the Native Fish Community to the Upper Rio Costilla Watershed, Draft Environmental Assessment, Submitted to U.S. Fish and Wildlife Service, Southwestern Region, Albuquerque, New Mexico.

New Mexico Environment Department. 1996. Final Report for the Rio Costilla and Comanche Creek Demonstration Project, Clean Water Act Section 319(h) Grant FY 91-G.

New Mexico Environment Department. 2011. Final Report for the Rio Costilla and Comanche Creek Demonstration Project, Clean Water Act Section 319(h) Grant FY 91-G.

New Mexico Environment Department. 2000. Quality assurance project plan for water quality management programs. NMED/SWQB EPA QAPP QTRCK Number Q-00-234.

New Mexico Environment Department, Surface Water Quality Bureau, Monitoring, Assessment and Standards. 2011. US EPA-Approved TMDL for Waters of the Valle Vidal. http://www.nmenv.state.nm.us/swqb/ValleVidal/ (accessed December 19, 2014).

New Mexico Environment Department, Surface Water Quality Bureau. 2014-2016. State of New Mexico, CWA §303(d)/§305(b), Final Integrated List & Report. https://www.env.nm.gov/swqb/303d-305b/2014-2016/ (accessed March 9, 2016).

Water Quality Control Commission. 2000. Title 20. Environmental Protection, Chapter 6: Water Quality, Part 4 Standards for Interstate and Intrastate Surface Water [20.6.4.1 nmac - rp 20 nmac 6.1.1001, 10-12-00]. http://164.64.110.239/nmac/parts/title20/20.006.0004.htm (accessed February 8, 2016)

DATA VERIFICATION WORKSHEET

Name of Data and Date Record	Complete Record [Y/N]	Instrument in working order [Y/N]	Checked for anomalous data [Y/N]	Verified by [name of reviewer]	Verified on [Date]

New Mexico Environment Department Surface Water Quality Bureau

Comanche Creek Watershed Based Plan
Quality Assurance Project Plan
Acknowledgement Statement

This is to acknowledge that I have received a copy (in hard copy or electronic format) of the Comanche Creek Watershed Based Plan *Quality Assurance Project Plan*.

As indicated by my signature below, I understand and acknowledge that it is my responsibility to read, understand, become familiar with and comply with the information provided in the document to the best of my ability.

_____
Signature

_____
Name (Please Print)

_____
Date

Return to SWQB Project Officer (Alan Klatt)